

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-128400

(43)Date of publication of application : 11.05.2001

(51)Int.Cl.

H02K 1/27
B60L 11/18
B60L 15/28
H02K 21/14
H02P 7/63

(21)Application number : 11-310006

(71)Applicant : MITSUBISHI HEAVY IND LTD

(22)Date of filing : 29.10.1999

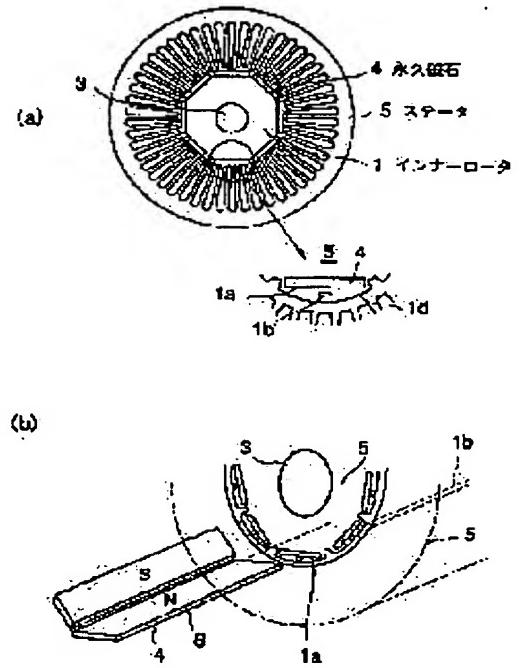
(72)Inventor : ISOBE SHINICHI
MORIMOTO MASAYUKI
HOSHINO AKIHIRO
SAKURAI TAKAO
SUGIURA HIROYUKI

(54) PERMANENT MAGNET EMBEDDED TYPE MOTOR AND VEHICLE UTILIZING THE SAME MOTOR AS A RUNNING DRIVE SOURCE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a permanent magnet embedded type motor, which reduces voltage drop due to inductance during a high speed operation and enables rotation using a low voltage of battery.

SOLUTION: A permanent magnet embedded type motor where a plurality of permanent magnets 4 are embedded in the inner rotors 1 which are allocated within the stator 5 via the air gap, a permanent magnet 4 is formed in a plate-type magnet, one side surface of the plate-type magnet is allocated in the external circumference side of the inner rotor 1, in opposition to the stator 5 and an air gap 1b for shielding a part of the magnetic path is provided between the one side surface and the external circumference of the inner rotor 1.



LEGAL STATUS

[Date of request for examination] 07.08.2002

[Date of sending the examiner's decision of rejection] 15.03.2005

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

*** NOTICES ***

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] In the permanent magnet embedding mold motor which two or more permanent magnets embedded to the interior of the inner rotor arranged through an air gap in a stator While forming said permanent magnet in a tabular magnet, countering said stator and arranging the field of one side of this tabular magnet to the periphery side of said inner rotor The permanent magnet embedding mold motor characterized by preparing the opening which intercepts a part of magnetic path between the field of said one side, and the periphery of said inner rotor.

[Claim 2] Said opening is a permanent magnet embedding mold motor according to claim 1 characterized by preparing in a location including the location where the flux density of said air gap (stator) serves as max.

[Claim 3] Said opening is claim 1 characterized by being a slot or a hole, or a permanent magnet embedding mold motor given in two.

[Claim 4] Said opening is claims 1 and 2 characterized by forming in the rectangle or the ellipse form where it has the 2nd dimension longer than said 1st dimension which intervenes to the magnetic flux which it is the direction which intersects the 1st dimension which intervenes to the magnetic flux which flows to an one direction, and the magnetic flux which flows to said one direction, and also flows in a direction, or a permanent magnet embedding mold motor given in three.

[Claim 5] It has the inner rotor arranged through an air gap in a stator. Said stator is countered in the field of one side of this tabular magnet, and two or more permanent magnets formed in the tabular magnet are embedded at the periphery side of said inner rotor. Between the field of said one side, and the periphery of said inner rotor While preparing in a location including the location where the flux density of said air gap (stator) serves as max in the opening which intercepts a part of magnetic path The 1st dimension between which it is placed by said opening to the synthetic magnetic flux of said stator which flows to an one direction, and said tabular magnet, It is the car using the permanent magnet embedding mold motor formed in the rectangle or the ellipse form where it has the 2nd dimension longer than said 1st dimension which intervenes to said synthetic magnetic flux which it is the direction which intersects said synthetic magnetic flux which flows to said one direction, and also flows in a direction as a transit driving source. The car using the permanent magnet embedding mold motor characterized by driving by said synthetic magnetic flux which flows to said one direction at the time of advance transit, and driving by said synthetic magnetic flux which flows in the other directions at the time of go-astern as a transit driving source.

[Translation done.]

*** NOTICES ***

JPO and NCIP are not responsible for any
damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the car which used for the driving source the permanent magnet embedding mold motor which two or more permanent magnets embedded to the interior of the inner rotor arranged through an air gap in a stator, and this motor.

[0002]

[Description of the Prior Art] Conventionally, a permanent magnet is embedded at the periphery side of an inner rotor, a current is passed from a cell through an inverter at the coil inserted in a stator, rotating-magnetic-field generating is carried out, and the permanent magnet embedding mold motor of an inner rotor and a stator which is made to generate a suction force and repulsive force magnetically, and is made to rotate an inner rotor is well-known.

[0003] Compared with the approach of sticking a permanent magnet on the periphery of an inner rotor, a permanent magnet does not separate according to the centrifugal force in the case of rotation of an inner rotor, and such a permanent magnet embedding mold motor can acquire large torque with the synthetic magnetic force of rotation magnetic force with the coil of a stator, and the permanent magnet of an inner rotor, and is desirable for the driving source of a car.

[0004] However, in a car, although high-speed operation is required at the time of advance, low r.p.m. operation is required at the time of go-astern, and at the time of a high speed, torque may be low, and large torque is needed at the time of a low speed. However, when using the conventional permanent magnet embedding mold motor as a motor for a car transit drive, it is only merely impressing and carrying out synchronized operation of the electrical potential difference to a stator coil through an inverter in the case of go-astern transit to advance transit and hard flow.

[0005]

[Problem(s) to be Solved by the Invention] And since the iron core section exists between the permanent magnet with which the motor of the above-mentioned configuration was embedded, and the periphery of an inner rotor, this iron core section serves as a magnetic path of the magnetic flux generated by stator winding, and the inductance of stator winding becomes large.

[0006] For this reason, it was difficult for the input voltage of a motor to become large since the voltage drop by the inductance becomes large at the time of high-speed operation, and to carry out high-speed operation by the low battery of a cell.

[0007] This invention aims at offering the permanent magnet embedding mold motor which made the voltage drop by the inductance small and made it pivotable by the low battery of a cell at the time of high-speed operation in view of an above-mentioned situation. Moreover, other purposes of this invention are magnetic reluctance's increasing and offering the permanent magnet embedding mold motor by which magnetic reluctance's decreases at the time of hard flow rotation at the time of one direction rotation of a motor. Moreover, other purposes of this invention are offering the car which performs advance transit by one direction rotation of this motor, and performs go-astern transit by hard flow rotation, using a permanent magnet embedding mold motor as a transit driving source.

[0008]

[Means for Solving the Problem] In the permanent magnet embedding mold motor by which two or more permanent magnets embedded **** 1 invention to the interior of the inner rotor arranged through an air gap in a stator Said permanent magnet is formed in a tabular magnet, and while countering said stator and arranging the field of one side of this tabular magnet to the periphery side of said inner rotor, it is characterized by preparing the opening which intercepts a part of magnetic path between the field of said

one side, and the periphery of said inner rotor.

[0009] Since according to this technique the stator was countered, the field of one side of a tabular magnet is arranged to the periphery side of an inner rotor and the opening was prepared between the field of said one side of said tabular magnet, i.e., said tabular magnet, and the periphery of said inner rotor, in order to intercept a part of magnetic path by this opening, magnetic reluctance can increase and the inductance of stator winding can be pressed down low. Therefore, if this technique is used at the time of high-speed operation, since the voltage drop of an inductance will become small and can make the input voltage low, high-speed operation is possible by the low battery of a cell.

[0010] Moreover, said opening is a means with this invention effective [also preparing in a location including the location where the flux density of said air gap (stator) serves as max]. According to this technical means, by preparing in a location including the location where the flux density of an air gap (stator) serves as max, since the effect on magnetic reluctance is large, it is desirable.

[0011] Moreover, as for said opening, it is desirable that they are a slot or a hole. this -- a technique -- a means -- depending -- if -- for example -- drawing 2 -- (-- a --) -- having indicated -- a hole -- one -- b -- you may be -- (-- b --) -- having indicated -- tabular -- a magnet -- inserting -- opening -- one -- a -- ' -- connecting -- a slot -- or -- a hole -- one -- b -- ' -- ***** -- inner -- a rotor -- a periphery -- having prepared -- a slot -- one -- b -- " -- you may be .

[0012] Moreover, said opening is a direction which intersects the 1st dimension which intervenes to the magnetic flux which flows to an one direction, and the magnetic flux which flows to said one direction, and also is a means with this invention effective [also forming in the rectangle or the ellipse form where it has the 2nd dimension longer than said 1st dimension which intervenes to the magnetic flux which flows in a direction].

[0013] according to this technical means -- an opening -- a rectangle -- or it forms in an ellipse form, and magnetic reluctance can be controlled by arranging the longitudinal direction of this opening in parallel or the crossing direction to the direction where magnetic flux flows, and an inductance can be controlled by it. That is, by arranging a gap in parallel to the direction where magnetic flux flows, there is little reduction in flux density, an output torque is large, by arranging in the direction which crosses to the direction where magnetic flux flows, magnetic reluctance increases, flux density decreases and an output torque decreases.

[0014] **** 2 invention is equipped with the inner rotor arranged through an air gap in a stator. Said air gap (stator) is countered in the field of one side of this tabular magnet, and two or more permanent magnets formed in the tabular magnet are embedded at the periphery side of said inner rotor. Between the field of said one side, and the periphery of said inner rotor While preparing in a location including the location where the flux density of said stator serves as max in the opening which intercepts a part of magnetic path The 1st dimension between which it is placed by said opening to the synthetic magnetic flux of said stator which flows to an one direction, and said tabular magnet, It is the car using the permanent magnet embedding mold motor formed in the rectangle or the ellipse form where it has the 2nd dimension longer than said 1st dimension which intervenes to said synthetic magnetic flux which it is the direction which intersects said synthetic magnetic flux which flows to said one direction, and also flows in a direction as a transit driving source. It is characterized by using the permanent magnet embedding mold motor characterized by driving by said synthetic magnetic flux which flows to said one direction at the time of advance transit, and driving by said synthetic magnetic flux which flows in the other directions at the time of go-astern as a transit driving source.

[0015] By arranging in parallel the opening formed in the rectangle or the ellipse form to the direction where said synthetic magnetic flux flows according to this technique There is little reduction in flux density, and in order that an output torque is large, and magnetic reluctance may increase by arranging in the direction which crosses to the direction where said synthetic magnetic flux flows, flux density may decrease and an output torque may decrease Since the time of go-astern transit, then the operation time of a car are longer than the time of the way at the time of advance transit, or go-astern transit, the case where consider the case where the longitudinal direction of said opening is arranged in parallel to the direction where said synthetic magnetic flux flows as the time of advance transit, and it is arranged in the crossing direction The way at the time of advance transit has a small current, and ends, and from the time of go-astern transit, a motor efficiency becomes high and can aim at reduction of cell power consumption.

[0016]

[Embodiment of the Invention] Hereafter, with reference to a drawing, the suitable operation gestalt of this invention is explained in detail in instantiation. However, the dimension of the component part indicated by this operation gestalt, the quality of the material, a configuration, its relative arrangement, etc. are not the

meaning that limits the range of this invention to it but only the mere examples of explanation, as long as there is no specific publication especially.

[0017] The top view of the inner rotor 1, (b), and (c) of the sectional view (a) showing the permanent magnet embedding mold motor which drawing 1 requires for the gestalt of operation of this invention, a perspective view (b), and drawing 2 (a)) are the partial diagrammatic view. In drawing 1, into the stator 5 which omitted and drew the coil, the inner rotor (henceforth Rota) 1 has stator 5 inside and a predetermined air gap, and fitting is carried out to the support shaft 3 support shaft 3.

[0018] Rota 1 consists of layered products of the sheet metal formed with the magnetic substance, as sheet metal-like Rota 1 is shown in drawing 2, while opening hole 1c to which said support shaft 3 fits in in the center is established, it has 1d of salient pole sections divided into eight, and opening 1b is established in 1d of these salient pole sections between opening 1a which inserts the tabular magnet 4, this opening 1a, and a periphery.

[0019] In addition, said opening 1b may be circular, a square shape and the rectangle mentioned later, and an ellipse form. moreover -- (b) -- being shown -- as -- opening -- one -- a -- ' -- one -- dead air space -- one -- b -- ' -- you may be -- moreover -- (c) -- being shown -- as -- a periphery -- cutting a groove -- having -- dead air space -- one -- b -- " -- you may be .

[0020] Drawing 3 is an electric block block diagram which drives a permanent magnet embedding mold motor. Between a cell 15 and stator winding 16, the inverter circuit 14 which consists of switching transistors Q1-Q6 with the diodes D1-D6 for reverse electromotive voltage prevention, respectively is arranged, and it drives through an interface circuitry 13 according to the program of storage 17 by the command of CPU (central arithmetic element)12. 11 is an I/O device.

[0021] As shown in the table indicated to drawing 3, by impressing V, U, and an electrical potential difference E one by one from the stator terminal W, synchronous normal rotation rotation can be carried out and the inversion drive of the drive of a permanent magnet embedding mold motor can be carried out by impressing Terminals U, V, and W and an electrical potential difference E conversely.

[0022] Next, the gestalt of **** 1 operation is explained using drawing 4. If the magnetic path of a part of magnetic flux is intercepted for the magnetic flux by the coil of a stator by opening 1b, the magnetic reluctance of a magnetic path becomes large and can press down the inductance of stator winding low. Therefore, since the voltage drop of an inductance becomes small and can make motor input voltage low when performing high-speed operation at this time, high-speed operation by the low battery of a cell is possible.

[0023] And since the effect on magnetic reluctance is large, as for said opening 1b, it is desirable to prepare in a location including the location where the flux density of said air gap serves as max.

[0024] Next, the gestalt of **** 2 operation is explained using drawing 5. Since it is parallel to the direction where the synthetic magnetic flux of the magnetic flux according [the longitudinal direction of an opening 10] to the coil of a stator and the magnetic flux by the tabular permanent magnet flows as shown in drawing 5 (a), there is little reduction of the flux density by the opening 10, and an output torque is large. Moreover, since the longitudinal direction of an opening 10 intersects the direction where said synthetic magnetic flux flows as shown in drawing 5 (b), there is more reduction in flux density than the case of (a), magnetic flux decreases, and the flux density of an opening 10 falls. Therefore, it is smaller than the case where an output torque is (a).

[0025] Therefore, when outputting the same torque, there are few currents for which the way in the case of drawing 5 (a) is needed since the flux density of an air gap is large, it ends, copper loss is reduced, and a motor efficiency becomes high.

[0026] And by arranging in parallel the opening formed in the rectangle or the ellipse form to the direction where the synthetic magnetic flux by the coil and tabular permanent magnet of a stator flows according to the gestalt of this operation, there is little reduction in flux density, an output torque is large, by arranging in the direction which crosses to the direction where said synthetic magnetic flux flows, magnetic reluctance increases, flux density decreases and an output torque decreases. Therefore, if it applies to a car by considering the case where consider the case where the longitudinal direction of said opening is arranged in parallel to the direction where said synthetic magnetic flux flows as the time of advance transit, and it is arranged in the crossing direction as the time of go-aft transit Since the operation time of a car is longer than the time of the way at the time of advance transit, or go-aft transit, the way at the time of advance transit has a small current, and ends, and from the time of go-aft transit, a motor efficiency becomes high and can aim at reduction of cell power consumption.

[0027]

[Effect of the Invention] As explained in full detail above, this invention can aim at reduction of the expenses power of a cell while enabling high-speed operation of the motor for a drive by the low battery of a cell.

[Translation done.]

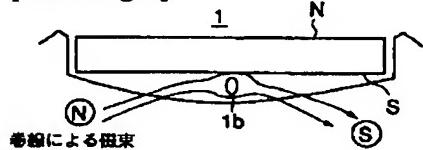
* NOTICES *

JPO and NCIPPI are not responsible for any
damages caused by the use of this translation.

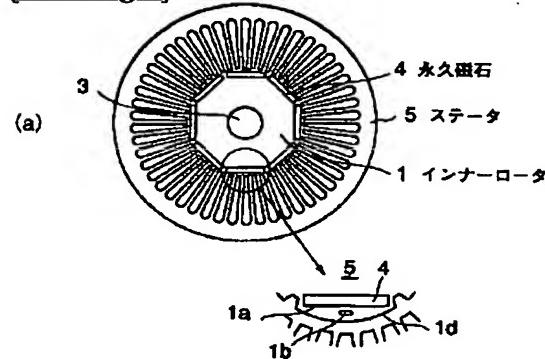
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

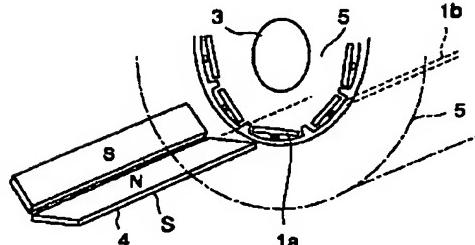
[Drawing 4]



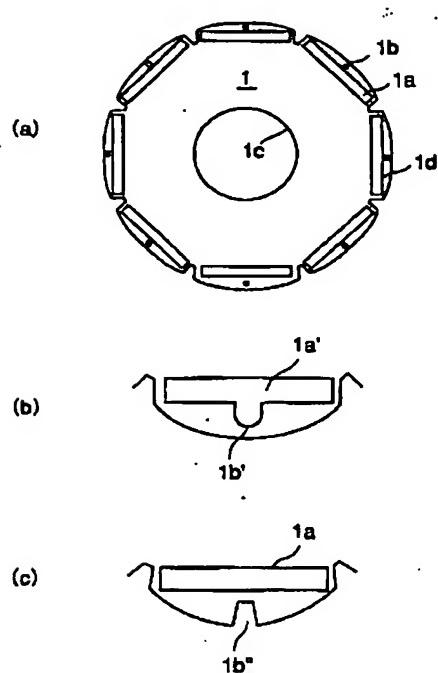
[Drawing 1]



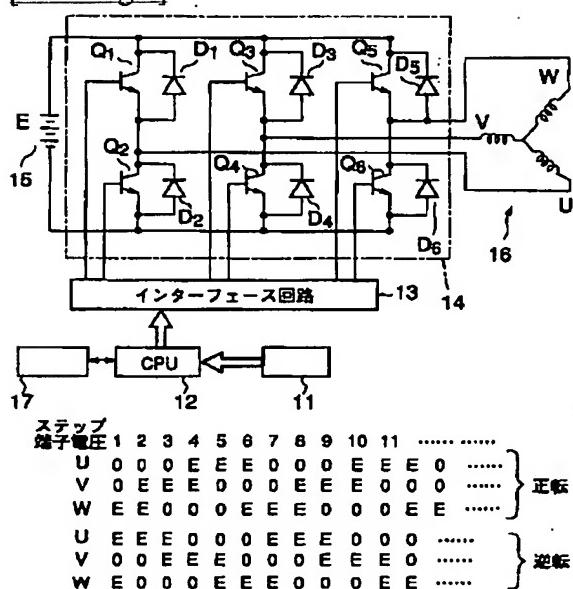
(b)



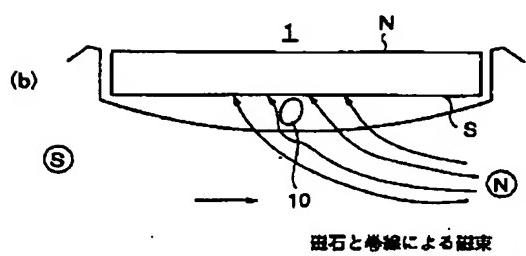
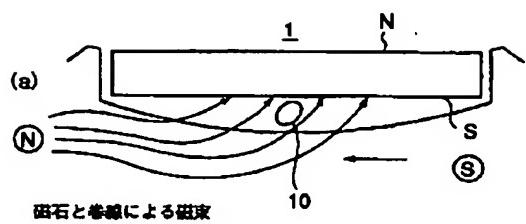
[Drawing 2]



[Drawing 3]



[Drawing 5]



[Translation done.]